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USSR WORK ON RICKETTSIOSSES

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Rickettsioses form a group of infections which are caused by special microorganisms, the so-called rickettsia. In regard to their morphology, the causative factors of rickettsioses are similar to bacteria; however, just like viruses, they are intercellular parasites and can be grown in substrates which consist of living tissues or tissues that have survived.

Under natural conditions rickettsioses are observed in blood-sucking arthropods, in some wild and domestic animals, and finally in humans. Among blood-sucking arthropods diseases of this class may assume one of a number of different courses. In arthropods the disease may proceed as a lethal infection, as for instance the exanthematous typhus rickettsiosis of lice, or as a symptomless infection of indefinite duration, one of the examples of the last variety being the exanthematous typhus rickettsiosis of fleas. Finally the symptomless infection existing during the life of the infected arthropods may be transmitted hereditarily and then represents the so-called transovarially transmitted type of rickettsiosis. Among minor wild animals, and particularly rodents, no symptoms are observed. Among farm animals rickettsioses do not occur at all, which applies for instance to Q fever, or they assume the form of an acute disease which is often lethal, as for instance the cardiac edema of cattle. Among humans rickettsioses represent a significant group of diseases of various degrees of acuity, which are accompanied as a rule by a characteristic skin rash. For that reason, they are called exanthematous typhus diseases or spotted fevers.

The following rickettsioses occur among humans: epidemic lice-transmitted exanthematous typhus and murine typhus, which is transmitted by fleas, the spotted Rocky Mountain fever, the Marseilles fever, the North Asiatic tick rickettsiosis, the vesicular rickettsiosis or rickettsial pox, Q fever or pulmonary rickettsiosis, tsutsugamushi fever, and the trench or Volyn' fever. The most malignant rickettsioses besides typhus are the Rocky Mountain fever, which results in 90% fatalities, and the Japanese tsutsugamushi fever, in which the fatality exceeds 30%.

The pathogenesis of rickettsial diseases is complex. In addition to the general intoxication of the organism, which is due to the formation of toxic substances by the Rickettsia, the disease is characterized by infectious and infectious-allergic affections of the blood vessels in the form of vasculites and thrombo-vasculites of various degrees of development, often accompanied by the formation of extravascular granulomas. In addition to organic deterioration of the blood vessels, functional disturbances of the blood circulation take place. These disturbances are connected with deficiencies of the nerve and humoral regulation of the circulation, and these deficiencies in turn are caused by an affection of the suprarenal glands. Typical for rickettsioses are the infectious-toxic affections of the cerebrum, which on the one hand cause pain syndromes and in acute cases various neuropsychic disturbances, and on the other hand produce disturbances of the nerve regulation of the basic functions of the organism in general. Finally one must note the formation of atypical pneumonia, which is characteristic for Q fever whenever the infection with it takes place by the respiratory path.

Infection with a rickettsiosis and recovery from it create homologous and heterologous immunity which is effective within the limits of the same group of rickettsial infections. For instance, recovery from any one of the tick rickettsioses produces pronounced immunity to other rickettsioses of the same tick group. On the other hand no immunity is produced against infections belonging to the exanthematous typhus group, Q fever, or other diseases of a different group.

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The sera of patients who are suffering from a rickettsiosis or of people who have recovered from a rickettsiosis exhibit, just as in the case of other infections, the capacity to produce various immunological reactions with reference to Rickettsia of the corresponding species. Particularly the serum yields a specific reaction of the agglutination of rickettsia and a reaction of complement fixation in the presence of a rickettsial antigen derived from the same microbiological species. This circumstance is used for the specific serum diagnosis of rickettsioses, which succeeds even in cases when the person had the disease a long time ago.

The epidemiology and epizootology of rickettsioses are characterized by the spread of these diseases among human beings and animals through the medium of blood-sucking arthropods, which eliminate rickettsiae either only in their excrements, as in the case of lice or fleas, or with the salivary secretion, as in the case of ticks or mites. In the first case the infection takes place when the excrements containing the causative factor get into skin wounds, skin abrasions, or into the mucous membranes; this is the manner in which the infection takes place in epidemic typhus, murine typhus, or Volyn' fever. In the second case the infection is transmitted by the bite of a tick or mite. This mode of infection is observed in all rickettsioses with the exception of those mentioned above and Q fever.

Only in rare cases are rickettsioses transmitted through the medium of infected elimination products of diseased animals, i.e., milk, urine, or manure of cattle. This applies principally to Q fever or pulmonary rickettsiosis. With the exception of epidemic typhus and Volyn' fever, human beings are infected with a rickettsiosis only in regions where the same infection is prevalent among animals susceptible to it. It is these animals together with the ticks or mites which live as parasites on them that form a natural reservoir of the causative factor.

In regard to their epidemiological and epizootological aspects, tick rickettsioses are governed by the laws pertaining to natural reservoirs which have been established by Ye. N. Pavlovskiy. Infected ticks transmit the disease to humans. Accordingly the seasonal occurrence of rickettsiosis corresponds to the period of the highest activity of ticks or mites, i.e., the season during which they attack mammals most frequently. For instance there is a spring maximum of the infection of human beings with the North Asiatic rickettsiosis, which is transmitted by various species of pasture ticks.

The science of Rickettsia and rickettsioses is at present regarded as an independent division of that branch of medical science which deals with infections. Accordingly, in the composition of Soviet microbiology, a new discipline has appeared in addition to those of bacteriology, protozoology, and virology; namely, rickettsiology. It is understandable therefore that in all plans made for research work rickettsioses represent an independent field of study.

However one must take into consideration that the body of knowledge on rickettsioses is still in the period of formation, and is being constantly supplemented by new facts and new discoveries.

During the period 1936-1953 Soviet investigators established the occurrence of the following endemic rickettsioses: murine typhus, Marseilles fever, and pulmonary rickettsiosis or Q fever. In addition to that the following rickettsioses were newly discovered: the tick-transmitted exanthematous typhus of Northern Asia, the tick vesicular rickettsiosis or rickettsial pox, and the tick-transmitted paroxysmal rickettsiosis. Furthermore one occasionally continues to observe the episodic occurrence of residual forms of ordinary typhus. In some regions Volyn' fever is observed.

Thus we have established the existence in the USSR of eight different types of rickettsiosis, including six endemic types which are connected with the existence of natural reservoirs of infection. Wherever these reservoirs occur, the infection is associated with the presence of an enzootic rickettsiosis affecting blood-sucking

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arthropods and mammals. It is understandable that endemic rickettsioses occupy a subordinate position within the total balance of infectious diseases and that they are basically of local importance only, occurring in the regions of the natural reservoirs. However it would be a mistake to undervalue or ignore these diseases. In addition to the fact that the diseases of this type are of regional importance, murine typhus and various types of tick or mite rickettsioses are locally confused with ordinary or epidemic typhus. This means that faulty diagnoses are being made and that antiepidemic measures are not being organized correctly. There can be no doubt that the same errors occur with reference to Q fever, which is reported under the name of chronic influenza, atypical pneumonia, an infection of the paratyphoid type, etc.

It is known from antiepidemic practice that epidemic rickettsiosis may become widespread. Thus in the US in 1944 and 1945 the incidence of murine typhus reached 5,000 cases per year. According to the view of American authors, the actual incidence of this rickettsiosis exceeded by five times the incidence which had been recorded officially.

The epidemic spread of Q fever may take place to a still wider extent. Q fever affects cattle and other livestock. Cattle infected with Q fever eliminate a very persistent causative factor with their milk, urine, excrements, and placenta. Infection of human beings then takes place through the air by means of infected dust. Material serving as a source of infection, for instance infected wool, hay, or cotton, may be transported over long distances and thus spread the disease.

For the reasons stated one must pay constant attention to the whole group of rickettsioses in addition to typhus, which should not be methodologically separated from other rickettsioses.

One must also bear in mind the possibility of the transmission from abroad of such malignant rickettsioses as tsutsugamushi fever and the Rocky Mountain spotted fever.

Unfortunately information on rickettsioses is not very popular among physicians and is usually limited to a knowledge of epidemic typhus. One must also recognize that a lack of adequate knowledge on the subject of rickettsioses also exists among physicians who are specialists in the field of microbiology, epidemiology, and infectious diseases. It is essential that the directing organs of the public health service take all necessary steps for the dissemination among the medical community of basic knowledge on rickettsioses.

The laboratory detection of rickettsial diseases, in addition to being based on data obtained in attempts to isolate the causative factor from patients, is best carried out by means of serological reactions. The reaction of the agglutination of Rickettsia is applied in epidemic typhus and murine typhus, also in Q fever. The reaction of complement fixation can be successfully applied in diagnosing all other types of the infections under consideration, including the total group of tick-transmitted and mite-transmitted rickettsioses. Accordingly the directing organs of the public health service must provide for the local organization of facilities for the specific serum diagnosis of rickettsioses. One must take steps to assure the production of rickettsial antigens. The methods and technology for this production have been completely developed at the Institute of Epidemiology and Microbiology imeni Gamaleya, Academy of Medical Sciences USSR.

The therapy of rickettsioses can be successfully carried out by means of the antibiotics synthomycin, levomycetin, and biomycin.

The fight with endemic rickettsioses basically amounts to the application of prophylactic measures, because the epidemiology of this type of disease demands that reliance be placed primarily on such measures. This means that we must first of all exterminate the transmitters of the diseases and prevent their attack on human beings.

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Measures directed against mammals which serve as reservoirs of the Rickettsia in nature must also be carried out. One must exterminate all rats and mice in regions where murine typhus or vesicular rickettsiosis exist. In connection with every type of rickettsiosis, these measures must be adapted to the particular epidemiological characteristics of this rickettsiosis. For instance, in the case of Q fever, special protection against alimentary or airborne infection is necessary. Infection in the case of Q fever is caused by elimination of the causative factor in the milk, urine, or excrements of cattle. In other words, boiling of the milk, disinfection of the cattle barns, burning of the manure, and other measures of this type are necessary. As far as specific prophylaxis within the group of endemic rickettsioses is concerned, one may expect that it will be practically feasible in the near future only with reference to Q fever.

The information outlined above gives a general review of the typical characteristics of rickettsioses. This review is designed to serve as an introduction into the specialized field of this group of infectious diseases.

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